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A STUDY OF DIETARIES AT LAWRENCE, KANSAS.

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Read before the Academy, at Topeka, January 1, 1903.

SCIENTIFIC investigation of the present day is pointing more strongly to the fact that without attention to the quality and quantity of the food consumed man can never be at his best morally, intellectually, or physically. Food is taken into the body to nourish it and enable it to perform properly its functions, but the appetite incites us to take food frequently which, both in kind and amount, is injurious.

As we are discussing more especially food substances, and their value in sustaining the machine which we call the human body, it is proper to notice the economic conditions that govern our choice. Just as the recent coal strike has led to the discovery and development of new fuels to take the place of anthracite, so the scarcity of food, from its high price or, what amounts to the same thing, a decrease in wages at any time, leads to the substitution of new food supplies and to the more economical use of those which we have.

The food materials contain water, proteids like the albumen of meat and eggs, carbohydrates like those in starch and sugar, fat from both the vegetable and animal kingdoms, and mineral salts. If the animal is allowed to eat the vegetable food, and we eat the flesh of the animal, we get the proteids in a concentrated form. In the vegetable kingdom, the leguminous plants, such as beans and peas, furnish the largest relative quantity of protein.

Looking over the broad field of food supply, we notice: First, foods are cheaper or dearer as they are in or out of season, but the season has been much extended by convenient and cheap transportation, and since canned fruits and vegetables have been introduced many vegetable foods are to be obtained throughout the year at reasonable prices. Second, there is very little relation between the cost of foods and their nutritive value. Beans are more nutritious than plum pudding, but they cost less. Third, a cheap food is not necessarily a poor food, or an expensive food a good food. Fourth, an expensive food can be spoiled for the palate and rendered unwholesome by poor cooking, and a cheap food can be made at least palatable and wholesome by skilful cooking.

Without going into details, it should be noted that foods like the protein compounds are mostly used to form the material of the body

and repair the waste, while foods such as the fats and the carbohydrates are used to keep the body warm and furnish the muscular power to do work.

In order to measure the value of a food, we adopt as a measure the calorie; that is, the amount of heat required to raise one pound of water from 0° to 1° centigrade. By this standard, one pound of protein will furnish 1860 calories; one pound of fat, 4220 calories; and one pound of carbohydrates, 1860 calories. In the adjustment of the proportion of these ingredients of the food, it is essential that we provide enough protein to build up and repair the tissues of the body, and enough fats and carbohydrates to keep the body warm and enable it to do its work.

Professor Voit, of Munich, one of the best authorities on this subject, has placed the standard for ordinary hard, muscular work as .25 pound protein, and carbohydrates and fats enough to yield, with the protein, 3050 calories of energy per day.

Professor Atwater suggests .28 pound of protein per day and a total of 3500 calories of energy for a man engaged in strong muscular labor. Professional men and students in Europe do well on .23 pound of protein and enough carbohydrates and fats to make up 2700 calories, but experience shows that in the United States the amounts actually used for this class are larger; in fact, about 3000 calories seem to be required.

In making calculation of the nutritive values of the food, the quantity of fat is multiplied by $2\frac{1}{4}$, as its fuel value is this much higher than the carbohydrates. To this product we add the carbohydrates and divide the sum by the protein. The nutritive ratio should be from 1:4.7 to 1:6.9. The examination of a large number of dietaries in use in this country shows that there is a tendency to use too much starch, sugar and fat in proportion to the protein. In Europe the quantity of fat is from 1 to 5 ounces per day; in the United States it is from 4 to 16 ounces per day. Well-to-do professional men in Germany use from 3 to $4\frac{1}{2}$ ounces of fat per day, while in the United States the same class of people use from 5 to $7\frac{1}{2}$ ounces per day. The carbohydrates amount to from 9 to 24 ounces as used in Europe, but the same class in the United States use from 24 to 60 ounces. The proportion of protein to carbohydrates in Europe is as 1 to 4.1 to 6, while in this country it is as 1 to 6.6-8.2.

Something over two years ago, I requested one of my students, who was a steward of a student club of forty-six members, to make a dietary study of the food consumed during one month. In making this study, he followed the plan outlined by Professor Atwater in Bulletin No. 28 of the United States Department of Agriculture. The

average fuel value was found to be 3923 calories, with a nutritive ratio of proteids and carbohydrates of about 1 to 8. This showed the fuel value to be high; that is, there was too much starch and sugar consumed for the class of work done. Three thousand calories, as has been previously stated, is considered sufficient for those who are not engaged in very active muscular work.

It is a significant fact that in the Southern states there is a still greater tendency to use too much fat, starch, and sugar, and too little lean meat. According to the statement of the club steward in the above, Kansas seems to have the Southern tendency. Less pork and corn-meal (substances rich in fats) should be used, and more lean beef, oatmeal, peas and beans—substances rich in proteids.

The cost of the food in this club was $19\frac{1}{2}$ cents per day per capita, or \$1.36 per week. There were twice as many females in this club as males, but it was the observation of the steward that the amount of food eaten was not diminished by this fact, although authorities reckon that a woman eats four-fifths as much as a man.

Much valuable food is thrown away, even when it is purchased at a high price. When we eat more than is good for us, we throw away food. Cases are mentioned in ordinary domestic life in which 7.6 per cent. of the food was thrown away with the kitchen waste, and as this waste was taken largely from the protein and fat, it was estimated that .1 of the protein and fat and .04 of the carbohydrates purchased were wasted. The fact is, then, we waste a greater proportion of the protein, which is the most expensive and the most needed form of nutriment.

More recently, through the courtesy of a steward of one of the clubs in the University, I have been able to make another comparison of food, with estimate of cost. In this club there were twenty-two persons, and the records are given for sixty-five days. The following is the reported value of the different kinds of food:

ARTICLES.	Protein.	Fat.	Carbo- hydrates.	Calories (fuel value).
ANIMAL FOODS:				
Beef, roast.....	45.31	36.03	.....	250.875
Beefsteak.....	10.56	5.06	.....	47.025
Veal.....	3.32	1.58	.....	13.800
Pork, fresh.....	6.80	14.00	.....	71.750
Pork, salt.....	.62	28.44	.....	121.110
Chicken.....	17.55	1.40	.....	38.610
Gelatine.....	5.35	.....	.....	9.960
Eggs.....	9.24	6.93	.....	47.586
Oysters.....	.35	.09	.....	1.340
Lard.....	.....	125.00	.....	422.000
Lard, leaf.....	.22	9.40	.....	40.100
Salmon.....	4.68	1.80	.....	16.320
Fish.....	1.74	2.49	.....	13.725
Milk.....	33.00	40.00	.....	325.000
Cheese.....	1.69	2.13	.....	12.420
Butter.....	1.07	80.95	.....	386.805

ARTICLES.	Protein.	Fat.	Carbo- hydrates.	Calories (fuel value).
VEGETABLE FOODS:				
Wheat flour.....	22.00	2.20	159.80	329.000
Graham flour.....	2.92	.49	17.91	40.625
Oatmeal.....	2.11	.99	9.55	26.200
Malta Vita.....	8.40	3.92	38.19	103.600
Grape-nuts.....				
Rice.....	.29	.02	3.17	6.520
Tapioca.....			2.59	4.950
Starch.....			4.50	8.375
Corn, canned.....	1.34	.65	9.12	21.840
Corn, roasting.....	.40	.22	3.04	7.270
Potatoes, Irish.....	40.32	1.90	343.68	720.000
Potatoes, sweet.....	5.76	1.53	99.84	203.520
Turnips.....	1.00		6.32	13.875
Pumpkin.....			.31	1.720
Tomatoes.....	.28	.05	.96	2.520
Peas.....	.86	.05	2.37	6.120
Cabbage.....	1.57	.22	4.12	11.625
Beans.....	5.40	.43	14.34	38.520
Crackers.....	4.50	4.18	33.58	87.550
Cakes, cookies.....	2.12	2.52	20.72	53.200
Sugar, granulated.....			253.00	470.580
Syrup.....			28.56	53.200
Honey.....			3.24	6.080
Bread.....	37.20	4.80	210.80	482.000
Bread, brown.....	1.95	.39	11.46	26.620
Cranberries.....		.10	1.78	3.870
Grapes.....	.56	.67	8.06	19.760
Bananas.....	.48	.24	8.58	18.000
Oranges.....	.07		1.02	2.040
Pecans.....	.17	.14	4.44	9.100
Apricots, canned.....	.41		10.56	72.000
Plums.....	.45		9.50	8.500
Plums, canned.....	.22		3.88	7.920
Lemons.....			.47	1.160
Chocolate.....	.38	1.46	.90	8.580
Baking-powders.....	.16		1.12	2.467
Celery.....	.22		.65	1.750
Apples.....	1.08	1.08	38.88	79.200
Peaches.....	.50		6.70	12.750
Peaches, canned.....	.25		3.88	7.920
Melons.....	.50	.25	6.75	15.000
Totals.....	285.37	393.73	1,287.95	4,762.978

The cost of the food in this case was reported at $17\frac{4}{5}$ cents per day per capita. At another date, when the tests were made for a shorter period, though under conditions that assured greater accuracy, the cost was $18\frac{1}{5}$ cents per day per capita.

The estimates were made on food as purchased, making the usual allowances for refuse, such as bone, skin, shell, etc., of the food, as these are bought and paid for at the rate of so much per pound or bushel or quart. These are no small items either, for some cuts of beef lose 20 per cent. from refuse and bone that cannot be used. Chickens, alive, lose 38 per cent. Fish lose from 40 to 50 per cent. in this way.

The amount of water, also, is more than we should at first suppose, both in meats and in vegetables. Sirloin steak contains 38 per cent., blue fish 43 per cent., potatoes 78 per cent., turnips 89 per cent. and bread 32 per cent. of water.

The most expensive items of this dietary are beef, which in the above estimate costs \$39.78, out of a total of \$242; and all the animal food, including meats, eggs, milk, cheese, and butter, costs \$142, or

59 per cent. Of the carbonaceous foods, the largest items were sugar, syrup, and honey, all together, \$13.30; and bread, white and brown, \$11.65. The calories per day per capita were 3437. The nutritive ratio, as shown by the amounts of proteins and fats together, and carbohydrates, estimated as previously noted, is 1:7.6.

Here again it will be seen that the total number of calories in the food is not so much out of the way, though a little high, but the same condition prevails as in the other case; that is, the nutritive ratio is wide—too much fat and carbohydrates in proportion to the proteids.

The table following gives some of the results observed both in this country and abroad in respect to *fuel value* of foods and *nutritive ratio*. These are selected from many hundred that have been published, so as to show an average and some special facts. Here also is seen the tendency of our Southern people to eat too much fat and starch. The figures in parentheses give the number of families or clubs studied.

COMPARISON OF DIETARIES.

	Fuel value (calories).	Nutritive ratio. 1:-
Negro farmers, Tennessee.....	3,270	11.8
Cotton operators, Lowell, Mass.....	4,650	7.6
Mechanics, etc., New England (20).....	5,275	7.3
Average for professional men (9).....	3,315	6.8
Saxony, working people (13).....	2,275	7.0
Middle class, European (11).....	3,150	5.3
Laborers, Bavaria (5).....	3,295	4.9
Javanese (World's Fair).....	1,490	4.5
Football team.....	6,070	6.6
Average wage-earner, Connecticut.....	3,605	6.7
United States army ration.....	3,550	6.8
Students' club, Connecticut.....	3,140	6.7
“ “ Missouri.....	3,560	8.0
“ “ Tennessee.....	3,520	8.3
“ “ average (15).....	3,700	7.4
“ “ Kansas.....	3,437	7.6